Q. DR. TARDIFF ARGUES THAT THE AT&T/WORLDCOM COST RESULTS ARE INVALID BECAUSE THEY FALL FAR SHORT OF VERIZON'S "REAL WORLD" COSTS, AS REFLECTED IN ITS BOOKS OF ACCOUNT.[54] SHOULD THE COMMISSION PLACE MUCH WEIGHT ON A COMPARISON OF MODEL RESULTS WITH VERIZON'S EMBEDDED COSTS?

A. No. The cost modeling sponsored by AT&T/WorldCom in this proceeding is intended to capture Verizon's *forward-looking* costs of providing unbundled network elements. The models should *not* return Verizon's embedded investment or expenses.

Dr. Tardiff admits that he would expect forward-looking costs to differ from embedded costs,[55] but he seems unconvinced. For instance, he goes on to imply that a comparison of the Synthesis Model's results to Verizon's booked costs is relevant "*[e]ven if* forward-looking costs and current costs do not match..."[56]

I suggest that the Commission instead turn Dr. Tardiff's proposed "test of external validity" around—the Commission should be skeptical of any cost study that too closely approximates the incumbent's embedded costs. As I explained in my rebuttal testimony, Verizon seems to have gone to significant effort to ensure that its cost results include all, or nearly all, of the company's embedded

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54 Tardiff Rebuttal at 40.

55 *Id.*

56 *Id.* (emphasis supplied).

expenses. Verizon has applied what it calls a "forward-looking-to-current adjustment" that is designed to increase its investment ratios in an attempt to recover its embedded expenses when its "forward-looking" investment drops below current levels. In other words, Verizon applies an adjustment based on a simple presumption that forward-looking expenses will be identical to current expenses. At its root, this presumption violates the Commission's clear finding that "[n]either a methodology that establishes the prices for interconnection and access to network elements directly on the costs reflected in the regulated books of account, nor a price based on forward looking costs plus an additional amount reflecting embedded costs, would be consistent with the approach we are adopting."[57]

Q. DR. TARDIFF SUGGESTS THAT IT WOULD BE IMPLAUSIBLE FOR VERIZON TO ACHIEVE EFFICIENCY GAINS AS LARGE AS THOSE IMPLIED BY THE DIFFERENCE BETWEEN CURRENT BOOK, OR EMBEDDED, COSTS AND THE PRICES IMPLIED BY THE COST RESULTS THAT AT&T AND WORLDCOM HAVE OBTAINED USING THE MODIFIED SYNTHESIS MODEL.[58] HAVE OTHER NETWORK INDUSTRIES ACHIEVED COMPARABLE EFFICIENCY GAINS AFTER BEING SUBJECTED TO THE FULL PRESSURE OF COMPETITION?

A. Yes, if one assumes that the post-deregulation decreases in real prices in those network industries reflect efficiency gains. For example, economists Robert Crandall and Jerry Ellig have concluded that network industries, such as long-

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57 *Local Competition First Report and Order* at ¶ 705.

distance telecommunications and railroads, have experienced real price decreases of as much as 45% within the first five years of the market being opened to competition.[59] Crandall and Ellig report real price reductions between 12 and 45 percent for natural gas, long-distance telecommunications, railroad and airline industries. For example, they find that real prices for long-distance telecommunications declined between 23 and 41% within the first five years after deregulation.[60]

These decreases in real prices are broadly consistent with the magnitude of decreases implied by the difference between Verizon's current book, or embedded, costs and the cost-based prices that AT&T and WorldCom have derived using the Synthesis Model. It would not be surprising for the efficiency gains from local competition to exceed the post-deregulation gains for long-distance telecommunications or railroads because those other network industries experienced a longer and broader exposure to competition (*i.e.*, the extended

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58 Tardiff Rebuttal at 35.

59 Robert Crandall and Jerry Ellig, *Economic Deregulation and Customer Choice: Lessons for the Electric Industry*, at 2. Drs. Crandall and Ellig cite studies by several other economists who have also documented significant real price reductions in newly deregulated network industries.

60 In other words, by 1989, competition in the long-distance industry may well have wrung out a substantial portion of the inefficient costs that existed prior to deregulation. Thus, Dr. Tardiff's comparison of the cost savings implied in the Synthesis Model to those expected of AT&T under price caps established in 1989 is not an apt measure of the difference between Verizon's current embedded costs and the costs achievable in a competitive local exchange market. Tardiff Rebuttal at 41.

history of long-distance competition pre-divestiture in the telephone industry and of intramodal and intermodal competition for railroads) than local exchange providers faced prior to the Act.

In contrast, I would be very surprised if Verizon did not achieve any significant efficiency gains and in fact experienced substantially higher network-related costs after being exposed to real competitive pressure. Verizon's proposed UNE price *increases* bear no resemblance to the pricing trends that economists have observed in network industries in which previously dominant firms have been subjected to such competitive forces.[61]

B. CONTRARY TO DR. TARDIFF'S ASSERTIONS, AT&T AND WORLDCOM HAVE MODELED SPARE CAPACITY COSTS IN A MANNER THAT SHOULD PERMIT VERIZON AT LEAST AS MUCH COST RECOVERY FROM CURRENT CUSTOMERS AS WOULD BE FEASIBLE IN A TRULY COMPETITIVE LOCAL EXCHANGE MARKET.

Q. DR. TARDIFF CONTENDS THAT AT&T AND WORLDCOM HAVE FAILED TO TAKE INTO ACCOUNT SPARE CAPACITY COSTS THAT REAL-WORLD COMPETITORS WOULD INCUR—AND WOULD PASS ALONG TO CURRENT CUSTOMERS.[62] IS HE CORRECT?

A. No. Dr. Tardiff appears to base his argument on the rebuttal testimony of Mr. Francis J. Murphy concerning the level of spare capacity that AT&T and

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61 For example, Verizon's proposed $25.12 statewide-average price for unbundled loops is 83% greater than the $13.76 statewide-average price that the Virginia Corporation Commission adopted in 1998.

62 *See, for example,* Tardiff Rebuttal at 18-19.

WorldCom have modeled and included in the costs of serving current demand. AT&T/WorldCom witness Mr. Pitkin explains in his surrebuttal testimony that there is actually much more spare capacity included in the per-unit cost of serving current demand that Mr. Murphy and Dr. Tardiff appear to believe, based on a simplistic review of the "target fill factors" used in the Synthesis Model. AT&T/WorldCom witness Mr. Riolo confirms that the effective initial utilization of capacity included in the Synthesis Model is low enough to provide sufficient spare to handle maintenance needs (defective pairs), customer churn and still leave room for a non-trivial amount of growth in demand. Thus, on a purely factual basis, Dr. Tardiff is mistaken.

Dr. Tardiff is even further wrong from a cost recovery perspective. He is correct that carriers in the "real world" make trade-offs among the lower unit cost of larger facilities, the lower placement costs of building more capacity up-front to serve future demand and the carrying costs of spare capacity. But he is completely off-base when he implies that all of the carrying costs of spare capacity should be attributed to, and recovered from, today's demand. Current customers do not cause Verizon to incur costs to serve future demand; Verizon incurs those costs because it has evaluated the trade-offs that Dr. Tardiff describes and has decided that it can serve future demand at a lower unit cost by building today and carrying spare capacity for use at some point in the indefinite future.

Verizon will not make the right investment decisions unless it bears the risk of recovering the carrying cost of today's spare capacity from future

customers. It strains credulity for Verizon to argue simultaneously that future demand is highly uncertain (as Dr. Hausman claims in support of his proposed markups to reflect the foregone option of postponing investment)[63] and that AT&T and WorldCom have modeled a network with too little spare capacity for growth. Verizon can mitigate the risk of stranded investment due to demand shortfalls by building less spare capacity, but it will have no incentive to manage demand risk if it is able to foist all of the carrying costs of spare capacity onto today's customers, including competing carriers that buy UNEs.

Q. ARE YOU SAYING THAT VERIZON SHOULD NEVER BE ABLE TO RECOVER THE CARRYING COST OF SPARE CAPACITY FROM ITS CUSTOMERS?

A. No, I am not. Verizon should be able to recover the carrying cost of spare capacity from future customers who purchase UNEs or retail services that use that capacity—but only to the extent that Verizon made the correct decision to build in advance of demand. There are a number of ways that one can model costs to approximate the unit costs that would result from correct application of this principle, but Verizon's approach is not one of them.

An example illustrates the problems with Verizon's approach to recovering the cost of spare capacity. Assume that 30% spare plant is built to accommodate future growth and that growth actually absorbs half of that spare

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63 Hausman Rebuttal at 5-7.

plant over the course of five years. In Verizon's view, prices should be set as if 30% spare plant exists over the entire five-year period and as if no revenues will be generated from those lines over the period. This is clearly an inaccurate method of assessing costs. If 30% spare capacity is built to take into account growth, then the future revenues that those lines will generate must also be taken into account, as well as the increase in utilization that will occur along with growth.

Because such a calculation is a difficult one, it is reasonable to assume that these factors will offset each other and thus that a TELRIC model does not need to assume spare capacity for growth. In any event, the Synthesis Model is conservative in that it does assume such spare capacity. I understand that the approach that AT&T and WorldCom is fundamentally similar to the approach that this Commission chose in designing the universal service version of the Synthesis Model, which is to assign the carrying cost of a certain amount of spare capacity to current customers while giving those customers the benefit of the lower unit costs associated with larger cable sizes, *etc.*

Neither Dr. Tardiff nor any other Verizon witness has provided any analysis to show that Verizon could achieve lower unit costs, on a net present value basis, by building more spare capacity. Without such an analysis, the Commission has no basis for requiring current customers to bear even more carrying costs for spare capacity than are built into the AT&T/WorldCom cost results. Indeed, there is no reason to believe that Verizon would be able to pass

along higher spare capacity costs to current customers if the efficiency of its chosen trade-offs were subject to a market test from competitors that had chosen to build less spare capacity up-front.

C. DR. TARDIFF'S ARGUMENTS CONCERNING SWITCH DISCOUNTS ARE BASED ON OUTDATED AND/OR INACCURATE ASSUMPTIONS AND DO NOT REFLECT TELRIC PRICING PRINCIPLES.

Q. DR. TARDIFF CLAIMS THAT, UNLIKE THE APPROACH THAT AT&T AND WORLDCOM HAVE USED IN THIS ARBITRATION, VERIZON'S APPROACH TO CALCULATING SWITCH DISCOUNTS "CONSERVATIVELY ASSUMES A MIX OF UPGRADES, GROWTH ADDITIONS, AND NEW SWITCHES FROM DATA PROVIDED BY ITS THREE VENDORS OF SWITCHING EQUIPMENT."[64] IS HE CORRECT?

A. No. As the AT&T/WorldCom Recurring Cost Panel rebuttal testimony explained, Verizon calculated switch discounts by relying almost exclusively on the discount for "growth" additions to its existing switches. The Recurring Cost Panel rebuttal also explained that this approach is contrary to TELRIC, as interpreted by the U.S. District Court for the District of Delaware, and produces an improper discount factor to apply in the SCIS model to Verizon's switch investment to serve *total* demand, not just growth in demand over a short term.

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64 Tardiff Rebuttal at 48-49.

Q. DOES THE VERIZON APPROACH TO SWITCH DISCOUNTS PRODUCE COST-BASED PRICES THAT MIMIC THE OUTCOMES ONE WOULD EXPECT IN A COMPETITIVE MARKET?

A. Not at all. In a competitive market, Verizon would have to meet or beat the prices of new entrants that have purchased new switches to serve expected demand. No new entrant would price switching based solely on the prices it pays to vendors for "growth additions."

Q. DR. TARDIFF CLAIMS THAT USING ONLY NEW SWITCH PRICES TO CALCULATE UNBUNDLED SWITCHING COSTS IMPLIES EITHER A MUCH HIGHER DEGREE OF SPARE CAPACITY THAN IS ASSUMED IN THE SYNTHESIS MODEL OR EXTREMELY FREQUENT BUILDING OF SMALL SWITCHES.[65] DOES HIS ANALYSIS REFLECT THE KIND OF "REAL WORLD" CONDITIONS THAT HE CLAIMS TO BE IMPORTANT FOR MODELING UNE COSTS?

A. No. In the "real world," switches virtually never exhaust on processor utilization, as AT&T/WorldCom witness Ms. Pitts explained in her direct testimony and as the A&T/WorldCom Recurring Cost Panel explained further in our rebuttal testimony. Therefore, the kind of growth that would cause Verizon to need to make additions at "growth" line prices is primarily growth in circuit-switched lines. Dr. Tardiff ignores the fact that circuit-switched lines will not be growing as rapidly on a forward-looking basis as they have done in the past because retail customers increasingly are turning to DSL and other non-circuit-switched

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65 *Id.* at 50-51.

alternatives to, *e.g.*, second lines for dial-up modems.[66] He also ignores the fact that Verizon itself has admitted that one of its switching vendors, Nortel, does not charge a substantial premium for "growth" lines, as compared to "new" or "replacement" lines.[67] All of these factors, combined with the spare capacity allowed for in the Synthesis Model, diminish the relevance of Dr. Tardiff's analysis to the "real world" with which he is so much concerned.

Similarly, these factors cast doubt on the relevance of Dr. Tardiff's reference to the premium of "growth" vs. "replacement" line prices in a 1995 McGraw-Hill switching survey[68] and his claim that switching vendors only provide "new" lines at such low prices because they know they will be able to sell a substantial proportion of total capacity at higher "growth" prices.[69] Nortel, a major vendor, clearly does not base its pricing to Verizon on such considerations. Moreover, circuit-switching vendors must be careful to establish initial prices for their product that do not push buyers toward other vendors or to an early commitment to packet switching.

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66 Verizon itself has forecasted rapid growth in DSL. Verizon Exhibit Part B-13, Demand.

67 Verizon Panel Direct in Maryland Public Service Commission Case 8879 (the Maryland UNE docket), May 25, 2001, at 78-79.

68 Tardiff Rebuttal at 49. The 1995 McGraw-Hill survey obviously does not characterize current switching contracts.

69 *Id.* at 51.

In summary, Dr. Tardiff's analysis of switch discounts ignores both TELRIC pricing requirements and "real world" considerations. He has provided no sound reason for the Commission to reverse its own analysis of reasonable forward-looking switch prices, as embodied in the switch cost curve used in the Synthesis Model.

IV. CONTRARY TO DR. SHELANSKI'S CLAIMS, AT&T AND WORLDCOM HAVE APPROPRIATELY APPLIED ECONOMIC CONCEPTS IN MODELING NON-RECURRING COSTS.

Q. DR. SHELANSKI ALLEGES THAT YOUR PROPOSAL TO APPLY A "REUSABILITY" TEST TO DISTINGUISH BETWEEN RECURRING AND NON-RECURRING COSTS SEEKS "TO REQUIRE ILECS TO RECOVER NON-RECURRING COSTS THROUGH RECURRING CHARGES."[70] IS THIS CHARACTERIZATION ACCURATE?

A. No. The reverse is true. My proposal seeks to prevent Verizon from recovering what are properly seen as *recurring* costs from *non-recurring* charges. Once again, the capital costs of plant, and the labor costs of installing it,[71] are *investments* in the network that should be recovered through recurring charges. Any cost can be seen as "one-time" in nature if viewed narrowly enough. For example, Verizon might construct an entire new loop to provide service in response to a service order request, and, although the costs of constructing that

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70 Shelanski Rebuttal at 19.

71 This "reusability" test also excludes all of the labor used to install that plant, because once the plant has been installed to serve one customer, another customer at the same customer premises could reuse that plant at no additional cost for that plant.

loop would be "incurred in response to a specific event,"[72] those costs are nonetheless properly treated as recurring. Significantly, another Verizon economic witness, Dr. Robert Tanimura, conceded in testimony before the Hawaii Public Service Commission that reusability is relevant to the identification of costs as recurring rather than non-recurring.[73]

Q. DOES YOUR PROPOSAL ALLOW A NEW ENTRANT "TO AVOID PAYING A ONE-TIME EXPENSE THAT IT HAS CAUSED THE ILEC JUST BECAUSE SOME OTHER USER MIGHT SOMEDAY BENEFIT FROM THAT EXPENSE."[74]?

A. No. Dr. Shelanski appears to have misconstrued what I have proposed. Dr. Shelanski complains that "someone must bear the cost of the CLEC's customer acquisition."[75] I did not suggest that the legitimate forward-looking, efficient non-recurring costs of transferring a customer to a new entrant should be not be borne by the competitor. Indeed, I noted in my direct that, after excluding the capital costs of plant and the labor to install it:

> This leaves the cost of performing the transaction as the costs that can be recovered in NRCs for unbundled network elements. These

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72 Shelanski Rebuttal at 18.

73 Hawaii Public Utilities Commission, Docket No. 7702, Reply Testimonyof Dr. Robert Tanimura on behalf of Verizon Hawaii Inc., (VH RYT-2), September 27, 2000, at 5.

74 Shelanski Rebuttal at 17.

75 *Id.* at 16.

are the costs of actually performing the tasks of preordering, ordering, and provisioning.[76]

My proposed test simply serves as a tool for identifying which costs are legitimately non-recurring. Thus, contrary to Dr. Shelanski's claim, there is no contradiction between my position and the Commission's prior view that it is appropriate to require customers to pay for non-recurring costs through non-recurring charges.[77] Investment in new plant has a lasting benefit to the network. A new entrant should not be asked to fund more than its fair share of the investment in Verizon's network, as Verizon proposes here.[78]

Q. DOES YOUR PROPOSED TEST SHIFT RISKS FROM THE NEW ENTRANT TO VERIZON, AS DR. SHELANSKI CONTENDS[79]?

A. Yes, but not in an inappropriate way. Verizon should bear the risk of recovering the costs of its network investment through recurring charges. The Commission's pricing rules flatly prohibit incumbents from recovering recurring costs through non-recurring charges.[80] Thus, the Commission has no latitude to approve a non-

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76 Murray Direct at 29.

77 Shelanski Rebuttal at 18, citing Memorandum Opinion and Order, *In the Matter of Investigation of Interstate Access Tariff Non-Recurring Charges*, 2 FCC Rcd 3498, 3501-02 ¶¶ 32-33 (1987) and Order, *In the Matter of MCI Telecommunications Corp. Application for Review*, 12 FCC Rcd 16565, 16571 ¶ 12 (1997).

78 Verizon has likewise proposed to charge new entrants more than their fair share for the upkeep of the network, by imposing costs for maintenance and repair in its non-recurring charges. *See* the AT&T/WorldCom NRC Panel Rebuttal and Surrebuttal.

79 Shelanski Rebuttal at 19-20.

80 *Local Competition First Report and Order* at ¶¶ 746-747.

recurring charge because of the risk that Verizon will not recover all of its costs if the Commission determines a given cost to be recurring in nature. Dr. Shelanski's citation of ¶ 751 of the Commission's *Local Competition First Report and Order* for the contrary position[81] is inapposite because the Commission explicitly noted in that same paragraph that the incumbent would have to create some mechanism to apportion costs among all who benefit from a one-time activity, rather than imposing all of those costs on the initial requesting CLEC. Verizon has proposed no such mechanism for its non-recurring charges, nor is it clear that such a mechanism would be administratively feasible.

Furthermore, Verizon is in the best position to manage the risk of cost recovery by making the use of its facilities attractive to both retail customers and potential purchasers of UNEs. Verizon's proposal to recover recurring costs through non-recurring charges, to the contrary, creates risks of non-recovery and erects additional barriers to entry[82] for the new entrant that would not otherwise exist.

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81 Shelanski Rebuttal at 17.

82 Although Dr. Shelanski apparently disagrees that non-recurring charges constitute barriers to entry (Shelanski Rebuttal at 15), his position is at odds with this Commission's prior findings. *See, for example,* Memorandum Opinion and Order, *In the Application of NYNEX Corp. Transferor, and Bell Atlantic Corp. Transferee for Consent to Transfer Control of NYNEX Corp. and Its Subsidiaries*, File No. NSD-L-96-10 (rel. Aug. 14, 1997), ¶ 197.

Q. DR. SHELANSKI ARGUES THAT RECURRING AND NON-RECURRING COSTS NEED NOT BE BASED ON COMMON UNDERLYING ASSUMPTIONS.[83] DOES HIS REBUTTAL TESTIMONY ON THIS ISSUE IN ANY WAY UNDERMINE THE BASIS FOR YOUR CONTRARY CONCLUSION?

A. No. Dr. Shelanski simply sidesteps the central points of my demonstration that recurring and non-recurring costs must be coordinated. The examples in my direct testimony show that it is impossible to make a rational decision regarding when and where to deploy forward-looking technology without considering the recurring and non-recurring cost consequences *of the same options*. In short, Verizon cannot be said to have done a total element cost analysis unless it accounts for the non-recurring cost effect that matches each recurring cost decision it makes.

It is surprising that Dr. Shelanski would forget this necessary component of a total element cost analysis as the relationships and tradeoffs between other types of costs such as maintenance and new investment play such an important role in his analysis.[84]

Contrary to Dr. Shelanski's assertion, and as I explained in detail in my rebuttal testimony, the existence of new technology choices does affect both

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83 Shelanski Rebuttal at Section II.C.

84 *See, e.g., id.* at 4.

recurring and non-recurring costs.[85] SBC's announcements concerning its "Project Pronto" initiative provide "real world" evidence of this fact. As I noted above, SBC has stated that the expected savings associated with "Project Pronto" are sufficient to fund the company's $6 billion investment in what is in large part an upgrade from an existing network architecture that relies primarily on older, all-copper plant to one that deploys a more forward-looking level of fiber and GR-303-compliant DLC.[86] It is my understanding that substantial portions of those cost savings are associated with reduced non-recurring costs to provision high-speed services. As this example illustrates, "real-world" investment decisions are dictated by the total recurring and non-recurring cost of technology choices. Once a competitor such as SBC chooses a technology that lowers both recurring and non-recurring costs, other firms must offer competitive pricing (both recurring and non-recurring) or lose market share to the firm that has adopted new technology with a lower cost structure. One cannot develop cost-based prices that mimic the outcomes of competitive markets by ignoring the effect of those technology choices on non-recurring costs, as Dr. Shelanski advocates.

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85 Notably, Dr. Shelanski asserts that Verizon opted to model a new technology mix network-wide in its recurring cost analysis "partly because it believed it was required to do so under the Commission's interpretation of TELRIC." *Id.* at 21. This statement signals that Dr. Shelanski does not entirely agree with Verizon's own approach to recurring costs, but he fails to provide any basis for concluding that the Commission's interpretation of TELRIC is not the same for non-recurring as for recurring costs.

Dr. Shelanski's responses to the analogies provided in my direct testimony also consistently miss the point. My analogy goes to the tradeoff inherent between costs of maintaining an older car and purchasing a new car. Dr. Shelanski suggests that my discussion is off-base because "Verizon VA's cost model seeks to recover all recurring costs assuming network-wide deployment of the efficient, forward-looking technologies it expects to deploy." As I noted above, because Verizon has not properly matched maintenance costs and other recurring expenses to the forward-looking types of investments it assumes, Dr. Shelanski's assertion is factually incorrect.

More important, the purpose of my analogy was simply to illustrate, using an example from everyday life, that the costs of maintaining and working with older equipment are fundamentally different (and typically higher than) the cost of maintaining and working with new equipment. This concept, with which Dr. Shelanski appears to agree, pertains equally to non-recurring costs. A Commission decision that allows Verizon to impose the higher non-recurring costs associated with non-recurring work on older equipment would dampen Verizon's incentive to update its network.

Dr. Shelanski's rebuttal concerning my analogy illustrating Verizon's proposed over recovery of loop "conditioning" costs also misses the point in a

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86 SBC *Investor Briefing*, "SBC Announces Sweeping Broadband Initiative," October 18, (continued)

fundamental respect. Dr. Shelanski's response evolves from his assertion that "if Ms. Murray is correct in assuming that the forward-looking cost of the older computer is $800, then that is the price Verizon VA will charge for that computer." My discussion on this point was intended to show what happens in competitive markets when costs decline. The $800 in question was provided as the market value of older equipment as a function of the $1,200 cost to produce superior new equipment minus the $400 cost required to upgrade the new equipment. Dr. Shelanski's extrapolation from my analogy goes astray at its root when he suggests that the $800 market value of the older equipment "is the price Verizon VA would charge" based on its cost study in this proceeding. In fact, neither the results his client presents nor those advocated by AT&T and WorldCom discount the cost of Verizon's older loop plant to the level that Dr. Shelanski seems to believe would be appropriate. Instead, using different approaches, both Verizon and AT&T/WorldCom advocate setting Verizon recurring UNE prices at the $1,200 cost level that reflects building new state-of-the art facilities. Dr. Shelanski then again highlights that Verizon may benefit from its embedded plant by actually experiencing and maintaining costs lower then the full $1,200 cost for new facilities – which again merely suggests that the TELRIC application provided by AT&T and WorldCom tends to be conservative.

1999, at 7.

My analogy makes that point and explains that it is incorrect to allow Verizon to add an additional $400 to upgrade its old plant to that total. Dr. Shelanski's analysis seems to confirm that finding.

V. CONTRARY TO DR. SHELANSKI'S CLAIMS, THE SWITCHING RATE DESIGN PRINCIPLES ENUNCIATED IN MY DIRECT TESTIMONY CORRECTLY REFLECT COST CAUSATION.

Q. DR. SHELANSKI TAKES ISSUE WITH AN EXAMPLE IN YOUR DIRECT TESTIMONY CONCERNING THE POSSIBILITY THAT VERIZON WOULD OVERRECOVER SWITCHING COSTS.[87] HAS HIS REBUTTAL TESTIMONY CHANGED YOUR POSITION IN ANY WAY?

A. No. It appears that Dr. Shelanski agrees with me that it is inappropriate to recover non-traffic-sensitive switching costs through traffic-sensitive rate elements.[88] Nor does he appear to disagree that one consequence of recovering non-traffic-sensitive costs through usage-sensitive prices is a risk of overrecovery. He simply sees this risk as being less serious because he mistakenly presumes—based solely on the testimony of Verizon witnesses Mr. West and Mr. Murphy—that a substantial portion of Verizon's switching costs are traffic-sensitive. He also further presumes, based on the testimony of Mr. West, that Verizon recovers all non-traffic-sensitive switching costs through its flat-rated port charge and only recovers traffic-sensitive costs through its MOU charge. Thus, the dispute

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87 Shelanski Rebuttal at 26-28.

88 *Id.* at 26.

between us comes down to the factual issue of whether Verizon has correctly identified the proportion of its switching costs that are traffic-sensitive and correctly designed its switching rate structure to recover only those traffic-sensitive costs from the usage charge. In her concurrently filed surrebuttal testimony, AT&T/WorldCom witness Ms. Catherine E. Pitts re-emphasizes the conclusion of the analysis presented in the AT&T/WorldCom Recurring Cost Panel rebuttal testimony, which demonstrated that Verizon's switching costs are in fact predominantly non-traffic-sensitive. Therefore, the facts do not support either Dr. Shelanski's rebuttal concerning the risk of overrecovery or Verizon's proposed switching rate design.

Q. DOES THAT CONCLUDE YOUR TESTIMONY AT THIS TIME?

A. Yes.

I, Terry L. Murray, hereby certify under penalty of perjury that the foregoing surrebuttal testimony is true and accurate to the best of my knowledge and belief.

September 19, 2001

Terry L. Murray

[Name]

ATTACHMENT A

FULL TEXT OF CHAPTERS BY WILLIAM J. BAUMOL AND RICHARD N. CLARKE (CHAPTERS 14 AND 15, RESPECTIVELY) IN *THE NEW INVESTMENT THEORY OF REAL OPTIONS AND ITS IMPLICATIONS FOR TELECOMMUNICATIONS ECONOMICS* (J. ALLEMAN AND E. NOAM, EDS., 1999)

14 Option Value Analysis and Telephone Access Charges

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Abstract – This paper explores the policy implications of the recent options value analysis for telecommunications. It shows that application requires very great care because otherwise, the actions taken, while they appear to follow the analysis, can actually go in the opposite direction. This is demonstrated by access fees for interexchange carriers' use of the local loop. Because options analysis shows that the true cost of an investment, including future opportunity cost, is greater than it appears to be, the access charges should apparently be raised accordingly to discourage excessive investment in facilities. But here, raising access fees, rather than discouraging investment, is likely to increase it. Increasing the cost of entry through the use of currently extant facilities will lead to increased facilities-based entry. This will thereby exacerbate any excessive investment rather than reduce it.

1. THE ISSUE

The very illuminating new analysis stemming from the work of Dixit and Pindyck has profound implications for both theory and practice. The theory is deep and may sometimes entail complex and subtle reasoning. In contrast, its practical consequences may seem straightforward and even easy. This paper, however, employs a very current and urgent issue to show that, even by using the new analysis to deal with applications, matters are not always as straightforward as they can appear to be.

In short, one can characterize the pertinent part of the new analysis as follows. It tells us that investment decisions typically have a cost component that has usually been overlooked, so that the total costs of such decisions (and, hence, their appropriate price) is normally underestimated. The overlooked cost component is the narrowing of future choices that a current investment commitment entails. By making such a commitment, the decisionmakers forego some of their future op-

tions. The decisions preclude choices the decisionmakers *may* prefer to change as the passage of time increases the information available to them. But such changes are no longer open to them because of their investment commitment.

Dixit and Pindyck note that this is obviously a real cost that can be avoided only by postponing the investment decision. They also demonstrate that using the net present values of the expected future revenues and costs as the decision criterion to choose between immediate investment and the postponement of the decision can lead to erroneous choices. Neglecting the value of the foregone options biases the decision in favor of current investment over decision postponement. The error cannot be cured without including the value of the foregone options as part of the cost of an immediate or early commitment. Thus, the true total costs of the investment are higher than they usually are calculated to be.

Moreover, the true *marginal* cost of increased investment can also be expected to be higher than it is usually estimated to be. So it seems plausible that there should be a concomitant enhancement of the efficient price of access to the resulting facility as well as that of any product using the facility as input. From the point of view of economic welfare, the role of such a price enhancement is the prevention of inefficient overinvestment by the market. That is, by reducing the quantities demanded, the enhanced prices will prevent the expansion of current investment commitments beyond the point called for by expected revenues and true costs, including foregone option costs.

This, in considerably oversimplified form, is the basic story, and it is, of course, fundamentally valid. However, the use of this reasoning for practical application, without careful consideration of the pertinent relationships, can lead to indefensible and inefficient decisions. This is demonstrated by relating the analysis to a hotly debated current issue – the appropriate level of the access fees that the local exchange carriers (LECs) should charge the interexchange carriers (IXCs) for access to the former's local-loop facilities.

2. APPEARANCE AND REALITY OF OPTION VALUE COSTS IN ACCESS CHARGES

The obvious interpretation of the options value scenario to the LECs' access fees seems straightforward enough. The appearance of the matter, which is very different from the reality, is the following. In order to enter the local telecommunications market, the IXCs desire to rent access to the LECs' facilities because it is likely to be less expensive for the IXCs than building duplicative facilities of their

own. The resulting increase in demand for the facilities may therefore require the LECs to enlarge the capacity of those facilities – an investment commitment that entails foregone future choices for the LECs. Everyone seems to agree that the appropriate access fees should be based on costs (even though there is heated dispute over which costs these should be). The apparent conclusion is that the access charges should be higher than they would be if the foregone option value were ignored in the calculation.

However, this all-too-easy conclusion ignores two vital considerations. First, the grant to the IXCs of access to the LECs' facilities is likely to require little, if any, expanded investment commitment. Second, an increase in access charges is likely to speed up and increase IXCs' commitment to facilities-based entry into the local markets. That is, it will provide an incentive for investment commitments *by the IXCs*, which themselves have a cost in terms of foregone option value. Indeed, it is plausible that this is the type of investment most in danger of being driven to excessive levels in terms of economic efficiency. Below, these two contentions are discussed in turn.

First, if IXC entry into the local telecommunications markets is successful, it will mean that the LECs will lose some of their local business to the new entrants (presumably made up for by LEC entry into the interexchange arena). In terms of local traffic, the transfer of some traffic from the LECs to the IXCs will reduce the LECs' use of their own facilities, leaving unused capacity available for rental to the IXCs. Thus, the entry should result in little, if any, need to expand capacity and investment. More than that – in the debates over the proper access charges before the many regulatory agencies involved in the process, *the LECs have repeatedly contended that entry will leave them with substantial stranded assets.* But this is tantamount to saying that, far from having to *expand* capacity, the LECs expect to have considerable excess capacity left on their hands. They patently cannot have it both ways – they cannot legitimately claim at the same time that entry will force them to make substantial new investment commitments with high option-value costs, and that entry will leave them with a significant burden of excess capacity.

Second, entry can lead not just to one but to two different types of investment decisions, either of which is in danger of being carried to levels that are excessive in terms of economic efficiency. And here it must be emphasized once more that efficiency in investment decisions is the central point of the new options value analysis. It has just been demonstrated that access prices that disregard the cost of foreclosed choices can conceivably lead to overinvestment by the LECs, although it was shown to be unlikely. *But the level of access charges can also result in overinvestment by the IXCs.* If those charges are too high but entry into the local

telecommunications market promises to be profitable, the IXCs may feel compelled to build duplicative facilities, even in cases where substantial excess capacity already exists on the LEC's local loop. It is at least plausible that this sort of overinvestment – the natural extension of uneconomic bypass – is the more likely possibility. And it can indeed occur when some of the option values most likely to be relevant are overlooked.

This, then, is the important point: foregone option value is a very real cost of a current commitment to invest. The failure to recognize and incorporate this fact into pricing decisions can, indeed, lead to an inefficient overallocation of resources to investment. But the implication for pricing is not always as straightforward as it may appear, which has been demonstrated here for telecommunications access charges because they should be set to avoid the inefficient overcomitment of resources by the IXCs and not only by the LECs. Thus, quite plausibly, option value analysis may well call for an access price that is *lower* than the one that would otherwise be adopted, rather than the higher price that a superficial consideration of the matter would recommend.

15 Rethinking the Implications of "Real Options" Theory for the U.S. Local Telephone Industry

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Abstract - Real options theories are an important advance in analyzing the value of various business arrangements. Because incumbent exchange carriers' business arrangements with their new competitors are at the center of regulators' efforts to demonopolize the U.S. local telephone industry pursuant to the Telecommunications Act, it is natural that these new arrangements should be inspected to determine whether they correctly reflect the import of real options' costs. Investors and regulators have recognized these considerations, and to the extent that certain real options models do not reach the same conclusion, it is because they have not been parameterized to reflect accurately the market conditions facing the U.S. local telephone industry.

Accounting for the option value of an investment is not new. Although appropriate mathematical formulations for option values have only been developed within the last twenty-five years, markets, investors and regulatory commissions have long incorporated options effects in valuing and pricing regulated services.[2] It is thus useful to evaluate whether more recent developments in "real options" theory have uncovered effects and considerations not previously known to or accounted for by markets, investors and regulators.[3] Certain analyses by real options proponents have suggested that lack of attention to these considerations in U.S. local telephone markets may possibly have caused prices for some regulated telecommunications services to incorporate less than half of their truly required return.[4] Given the potential significance of these claims to an industry with over $100 billion in commerce annually, it is important that the underlying analyses be examined to determine whether:

(a) Real options theories are simply invalid[5] or

(b) Real options theories are valid and have been parameterized by their proponents to model the local telephone industry accurately – with the foreboding implication that the incumbent local exchange companies incumbent local exchange carriers (ILECs) may be on the brink of financial ruin or

(c) Real options theories are valid, but have not been parameterized to model the local telephone industry accurately.

This paper examines the validity of each of these possible conclusions about real options. Conclusion (c) is the most compelling. When real options models are parameterized to represent the local telephone industry accurately, these models affirm that investors and regulators have incorporated appropriate real options considerations into their investment evaluations and ratemaking decisions for ILEC local telecommunications services.

1. MIGHT THE ENTIRE THEORY BE INVALID?

While it is possible that the entire theory of real options is in error, this seems unlikely. First, this theory is not especially new, and due to its notoriety it has been exposed to substantial scrutiny from professional economists. If the theory is simply wrong, its deficiencies should already have been revealed in the literature. A second reason to doubt the invalidity of real options theory is that when these models are parameterized realistically, they appear to generate predictions that comport with current conditions and expectations. Thus, it seems unlikely that conclusion (a) is correct.

2. MIGHT THE THEORY AND ITS CURRENT PARAMETERIZATIONS BE CORRECT?

If proponents of real options theory such as Hausman have correctly parameterized their models of real options to reflect accurately the conditions of the local telephone industry, the implications are profound. These parameterizations suggest that rather than enjoying rather high and relatively riskless returns, ILECs are actually in grave financial danger; and to ameliorate this, their returns on services incorporating significant options value may need to double, or more.[6] Thus, given that return and income tax components constitute 30 percent of a typical ILEC's total revenue and depreciation constitutes an additional 22 percent, the return and/or depreciation inadequacies suggested by these real options parameterizations could be as large as half of the affected services' current revenues. Correcting this would require that regulators quickly grant ILEC rate increases of up to 50 percent for these services.

This foreboding view of the current ILEC financials, however, does not appear to be shared by investors, regulators, or by the ILECs themselves. In particular, even recent forward-looking determinations of the major ILECs' cost of capital using

standard discounted cash flow or capital asset pricing model methods confirm that based on current investor expectations, the weighted average cost of capital to the ILECs is in the 9 percent range - and certainly not in the 20 percent to 30 percent range as speculated by certain of the real options models using their proposed parameterizations.[7] Indeed, if the ILECs' "true" cost of capital is in this elevated range and a substantial portion of their services is subject to real options effects, it is remarkable that ILEC bond ratings remain at the highest investment levels, and that none of the over 1300 ILECs has gone bankrupt in recent memory.[8]

Equally telling is the fact that the ILECs themselves also appear not to believe that their proper cost of capital is in the 20 percent to 30 percent range. In comments they have made to the Federal Communications Commission concerning their authorized rate of return, none suggested that their return should be set at such levels.[9] Furthermore, no ILEC appears to have pointed toward real options theory as a justification for any increased return level.

Thus, because none of these groups, which have significant interest in the financial status of the ILECs, appears to believe that current returns are inadequate to provide ILECs with a profitable, sustainable financial future, it appears unlikely that conclusion (b) is correct.[10]

3. MIGHT THE THEORY BE CORRECT, BUT ITS PARAMETERIZATION BE WRONG?

It is not a necessary feature of real options theories that they should project overall ILEC rates of return to be inadequate. This projection is critically sensitive to the parameterization of the real options model in question. Among the parameter values that appear to be necessary to support a conclusion that current ILEC returns are inadequate are:

- Most ILEC investment is sunk and irreversible, and regulator-set price and sales conditions are irreversible, too.
- The effect of technical progress is always to devalue earlier investments.
- There is a competitive gain to "waiting" before deciding to make investments and enter the product market.
- The terms and conditions that the Telecommunications Act specifies for the provision of network elements and interconnection are fundamentally different and less favorable to the ILECs than the terms and conditions under which the ILECs currently market local and access services.[11]

A closer examination will reveal that each of these suppositions is inaccurate.

3.1 Irreversibility?

The vast majority of ILEC investments are not sunk and/or irreversible. In the event of a local demand insufficiency, a large portion of telecommunications equipment can be physically moved to locations where market conditions are more favorable. Furthermore, even outside-plant facilities that cannot be physically moved can be transferred to buyers who find these facilities more valuable than the ILEC. Indeed, the ILECs have transferred several million customer lines from one to another over the last five years.[12] That such transfers may still be infrequent should not be construed as evidence that these investments are irreversible. Rather, they reflect both the facts that telecommunications demand has uniformly been growing at a substantial rate throughout the country (with this growth projected to continue, if not accelerate), and that the depreciation lifespans of most telecommunications equipment have been relatively brief.[13] Indeed, ILECs have refused to dispose of even what they claim are their least-profitable investments.[14] But if ILEC investments are reversible from a financial perspective, they do not incorporate significant real options value.

Any analysis of the effects of reversibility on options value and risk would be incomplete if it focused solely on the physical reversibility of investments. Many important financial aspects of the provision and sale of regulated monopoly network elements and interconnection are more reversible than comparable aspects of unregulated competitive markets. For example, regulators frequently allow their decisions about prices or permitted uses for a network element to reverse equally earnest earlier decisions. The risks generated by such reversibility commonly have a chilling effect on the likelihood that a new entrant local carrier will be able to assemble the capital required for successful market entry. Examples of these effects of reversibility include public utility commissions abrogating contractually agreed-to prices for unbundled loops in favor of higher prices supported by their own cost "studies," or permitting ILECs to renege on supplying special-access transport services for resold Centrex lines after it became apparent that this permitted new-entrant carriers profitable and efficient use opportunities.[15] Thus, it is by no means clear whether the overall effects from the reversibility or irreversibility of investment and regulatory decisions favor or disfavor the ILECs.

3.2 Technological Progress?

While it is true that technological progress may have devalued certain earlier ILEC investments in central-office switching and interoffice transmission, this is not a representative example. Only about 20 percent of all forward-looking ILEC investment is for these network elements, whereas 60 percent to 70 percent of their

investments are in outside-plant facilities. Because of increased congestion and urbanization, outside-plant investments commonly have appreciated in value, not depreciated.

In addition, technologies may arise that make "old" investments appreciate in value. A useful example is xDSL, or digital subscriber line. In the early 1990s, the received wisdom was that copper loop distribution plant in local telephone networks was economically obsolete. Because it would not support the high-speed services that customers were beginning to demand, no more of it would be installed, and the installed base would be replaced rapidly by fiber optic or coaxial distribution cables. Instead, these latter distribution technologies have turned out to be much more expensive than previously anticipated, and xDSL technologies have arisen that allow the embedded copper loop distribution cables to be used efficiently to provide high-bandwidth services. Thus, because of the great cost of replacing these cables, they are now more valuable than when they were initially installed.

3.3 Gains from Waiting?

Another key parameter in real options models is whether there are gains from waiting to invest.[16] If such gains are assumed to exist, then ILEC prices for network elements and interconnection may yield insufficient returns because they fail to incorporate the value of the "free option" of waiting to invest that they offer purchasers. But in the telecommunications industry, gains typically do not flow to those who wait, but rather are reaped by those who can become "first movers."[17] Even if investment costs are expected to decline in the future, it is typically more profitable to enter a market quickly, accumulate customers and experience, and then, because of the flexibility inherent in telecommunications networks, transition these customers to the newer, lower-cost technologies that may have been developed subsequently.

3.4 Different Terms and Conditions?

Many of the real options analyses suggesting that new unbundled network elements or interconnection prices may be set too low to allow ILECs to earn adequate returns appear to assume that the terms and conditions under which the ILECs must sell these items are more disadvantageous to the ILECs than the terms and conditions under which they sell their current local or access services. As an example, it is alleged that purchasers of network elements or interconnection will receive a unique options advantage because they may discontinue their purchases.

However, the requirement to offer services on a month-to-month basis is typical for all services offered by the ILECs. Thus, purchasers receive no distinct options value from new interconnection services vis à vis purchasers of traditional ILEC access services. Indeed, because the sale of new interconnection services pursuant to the Telecommunications Act permits the use of negotiated contractual arrangements, the ILEC likely has more ability to appropriate the value of the real options aspects of these sales than sales of its traditional local and access services. This is because the latter type of services frequently can only be offered pursuant to regulator-approved tariffs incorporating specific terms and conditions.[18]

4. CONCLUSIONS

Real options theories are an important advance in analyzing the value of various business arrangements. Because ILEC business arrangements with their new competitors are at the center of regulators' efforts to demonopolize the U.S. local telephone industry pursuant to the Telecommunications Act, it is natural that these new arrangements should be inspected to determine whether they correctly reflect the import of real options' costs. This report finds generally that investors and regulators have recognized these considerations, and to the extent that certain real options models do not reach the same conclusion, it is because they have not been parameterized to reflect accurately the market conditions facing the U.S. local telephone industry.

NOTES

[1] The opinions expressed here are solely the author's, and do not necessarily represent those of AT&T.

[2] The first rigorous development of the mathematical theory of financial option values was provided in Black, F. and M. Scholes. 1993. "The Pricing of Options and Corporate Liabilities," *Journal of Political Economy*, No. 81, pp. 637-659.

[3] Major contributions to real options theory include: Dixit, A. and R. Pindyck. 1994. *Investment Under Uncertainty*, Princeton University Press. McDonald, R. and D. Siegel. "Investment and the Valuation of Firms When There is an Option to Shut Down," *International Economic Review*, Vol. 28, No. 2, pp. 331-349; Pindyck, R. "Irreversible Investment, Capacity Choice and the Value of the Firm, *American Economic Review*, Vol. 78, No. 5, pp. 969-985. Hubbard, R.G. "Investment Under Uncertainty: Keeping One's Options Open," *Journal of Economic Literature*, Vol. 32, pp. 1816-1832, provides a useful summary.

[4] See, for example, Jerry Hausman, "The Effect of Sunk Costs in Telecommunications Regulation," in this volume, which states, "A ... calculation which ignores the sunk cost feature of telecommunications network investments would thus be off by a factor of two."

[5] If these theories are invalid, it makes no difference whether they have been parameterized accurately – their results are simply irrelevant.

[6] Hausman, op. cit.

[7] See, *Direct Case of the General Services Administration* ("GSA calculates the weighted cost of capital as 9.27 percent"), filed January 19, 1999 in Federal Communications Commission CC Docket No. 98-166; or *Responsive Submission of AT&T Corp.* with its accompanying *Affidavit of Bradford Cornell and John I. Hirshleifer* ("applying established financial economics principles to the market data on the publicly-traded firms that operate local telephone networks yields a weighted average cost of capital range of no higher than 8.5% to 9.5%"), filed March 16, 1999 in the same proceeding.

[8] The absence of bankruptcy among such a large group of industry members is unprecedented. Rather than revealing an industry in a precarious financial position, it suggests that the earnings currently available to ILEC monopolies are both high and stable – or that few ILEC services are subject to significant real options effects.

[9] See, for example the *Comments of GTE* ("there is no basis to alter the current prescribed authorized rate of return of 11.25%"), filed January 19, 1999 in Federal Communications Commission CC Docket No. 98-166; or the *Comments of Bell Atlantic* ("the Commission should not adjust the prescribed rate of return") filed in the same proceeding.

[10] Indeed, if conclusion (b) is correct and a significant portion of ILEC services is affected, then the people privy to these real options analyses and their import should be shorting ILEC stocks in anticipation that once this information is assimilated by the larger financial markets, there will be a significant drop in ILEC stock prices.

[11] This note focuses only on the terms and conditions that are explicit in the Telecommunications Act and that are relevant to real options issues. It does not address ancillary complaints that are sometimes included in presentations on real options that claim, incorrectly, that the Telecommunications Act somehow requires regulators to blind themselves to economic factors such as risk or technological obsolescence in the setting of appropriate prices or depreciation rates.

[12] While many of these sold lines were in rural exchanges owned by large ILECs and sold to smaller ILECs, many also were transfers between large ILECs, e.g., Sprint/Centel to Ameritech, GTE both to and from Alltel.

[13] The average depreciation life for telecommunications equipment is just over 14 years. In contrast, electric power generating and transmission equipment may frequently have lifespans of 30 years and more. See U.S. Department of Energy, Energy Information Administration, Form EIA-412, "Annual Report of Public Electric Utilities," demonstrating that in 1997, the average life of electrical plant was 32.5 years.

[14] As an example, in the early 1990s, NYNEX claimed that only its midtown and downtown Manhattan exchanges were profitable, and that its other New York City exchanges generally "lost" money. But when Teleport then offered to purchase any of these "unprofitable" exchanges at their net book value, NYNEX refused to sell. See "The Local Call Goes Up for Grabs," *New York Times*, December 29, 1991, Section 3, p. 1.

[15] See "In the matter of U S West Tariff F.C.C. Nos. 3 and 5," FCC Common Carrier Bureau *Order on Transmittal 629*, September 28, 1995.

[16] In addition to gains from waiting to invest, there may be other advantages in managerial flexibility that incorporate real options value. See L. Trigeorgis. 1996. *Real Options: Managerial Flexibility and Strategy in Resource Allocation*, MIT Press.

[17] Witness the first mover value of "1-800-COLLECT" in MCI's establishment of the dial-around market, or "Digital One Rate" in AT&T's establishment of the seamless wireless services market. In contrast, it is difficult even to identify the secondary entrants such as AT&T's "1-800-OPERATOR" or Bell Atlantic's "DigitalChoice SingleRate USA" or Sprint PCS' "Free and Clear" offerings.

[18] For example, local service tariffs often prohibit offering volume or term discounts.